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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/053,446	01/17/2002	Janis Virbalis	VIRBULIS ET AL -1	3544

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COLLARD & ROE, P.C
1077 Northern Boulevard
Roslyn, NY 11576-1696

EXAMINER	
SONG, MATTHEW J	
ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 11/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/053,446	VIRBULIS ET AL.	
	Examiner	Art Unit	
	Matthew J Song	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 02 September 2003.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-14 is/are pending in the application.

4a) Of the above claim(s) 5-13 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-4 and 14 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. This application contains claims 5-13 drawn to an invention nonelected with traverse in Paper No. 8. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-4 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites, "said traveling magnetic field being the single type of magnetic field which is applied to the melt" in the last 2 lines. The instant specification does not teach a single type magnetic field. Applicant alleges Examples 1 and 2 and Fig 1 provides support for the limitation. The cited passages of the instant specification do not explicitly teach a single type magnetic field. The instant specification does not use the phrase "single type magnetic field".

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

5. Claims 1-4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 recites, "said traveling magnetic field being the single type of magnetic field which is applied to the melt" in the last 2 lines. The instant specification does not teach a single type magnetic field. Because a single type magnetic field is not defined in the specification, it is unclear what is a single type magnetic field. In other words, the distinction between a single type and a double type is unclear.

6. Regarding claims 1-4, the phrase "type" renders the claim indefinite because it is relative term. Furthermore, it would be unclear to a person of ordinary skill in the art, in light of the specification because specification does not teach a "single type". See MPEP § 2173.05(b).

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-4 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tamatsuka et al (US 6,139,625) in view of Luter et al (US 6,053,974) along with Szekely et al (US 5,196,085) and Lari et al (US 4,905,756) or Morishita et al (JP 61-029128), an English abstract has been provided.

Tamatsuka et al discloses 8-inch diameter (203.2 mm) silicon single crystal ingots were pulled by the Czochralski method with an oxygen concentration of $0.7x10^{18}$ atoms/cm^3 or more (Table 1) from a silicon melt in a quartz crucible with a diameter of 18 inches (457.2 mm) (col 8, ln 1 to col 9, ln 65).

Tamatsuka et al does not disclose a heat shield above the crucible.

In a method of forming a single crystal by the Czochralski method, note entire reference, Luter et al teaches a heat shield **40** mounted above the surface of a molten source material for growing ingots with a diameter of about 220 mm (Fig 1, col 4, ln 1-67 and col 5, ln 1-15). Luter et al also teaches the overall gradient at the surface is reduced which reduces the number of defects at the surface and the distribution of defects is more even throughout the ingot for ingots produced with the heat shield (col 7, ln 1-15). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Tamatsuka et al with Luter et al's heat shield to reduce defects in the ingot.

Tamatsuka et al is also silent to exposing the silicon melt to an influence of a traveling magnetic filed which exerts a substantially vertically orientated force on the melt in a region of the crucible wall.

In a method of controlling the flow in Czochralski (CZ) systems, note entire reference, Szekely et al teaches a CZ growing system with an axial magnetic filed in the vicinity of the melt-crystal interface and melt stirring can be accomplished magnetically by inducing vertical motion with a traveling field. Szekely et al also teaches controlling the flow in the bulk and in the vicinity of the wells (col 2, ln 1-60). Szekely et al also teaches the magnetic filed with an axial upward or downward direction applied selectively at the growing crystal surface vicinity in

combination with a moving magnetic filed (col 3, ln 10-62). Szekely et al also teaches vertical magnetic fields are useful for stabilizing flow (col 1, ln 5-62). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Tamatsuka et al with Szekely et al's vertical magnetic field because flow instabilities are eliminated (col 1, ln 65-68).

The combination of Tamatsuka et al, Luter et al and Szekely et al teach all of the limitations of claim 1, except the traveling magnetic filed being the single type of magnetic field which is applied to the melt. The combination of Tamatsuka et al, Luter et al and Szekely et al teaches providing a traveling magnetic field but is silent to the means of producing the magnetic field.

In an apparatus for producing magnetic fields, note entire reference, Lari et al teaches a magnetic field traveling wave is produced with only two coil layers with current 180° out of phase and in the preferred embodiment, three coil layers 120° out of phase are used, this reads on applicant connections of the coils have a phase angle in an order of 0°-120°-240°. Lari et al also teaches an AC source supplies three-phase alternating current. Also, additional coil waves could de used to produce a traveling wave, for example four coils 90° out of phase. Because the term "single type" is indefinite, as discussed previously, the Examiner has interpreted a similar means of producing a traveling wave will inherently produce a similar type of wave. The three coil layer 120° out of phase is similar to the apparatus used by applicant, note Example 1;therefore would inherently produce a single type wave. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Tamatsuka et al, Luter et al and Szekely et al with Lari et al's means of producing a traveling magnetic field because

selection of a known material based on its suitability for its intended use is held to be obvious (MPEP 2144.07).

In an apparatus for providing a magnetic field, Morishita et al teaches a magnetic generator made of a coil **30**, which is formed of coils 31a, 31b 31c. And when a 3-phase AC current having 120° different positions are respectively flowed to the coils, a traveling magnetic field which moves in a prescribed direction is generated (Abstract), this reads on applicant connection of the coils have a phase angle in an order of 0°-120°-240°. Because the term "single type" is indefinite, as discussed previously, the Examiner has interpreted a similar means of producing a traveling wave will inherently produce a similar type of wave. The three coil layer 120° out of phase is similar to the apparatus used by applicant, note Example 1; therefore would inherently produce a single type wave It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Tamatsuka et al, Luter et al and Szekely et al with Morishita et al's means of producing a traveling magnetic field because selection of a known material based on its suitability for its intended use is held to be obvious (MPEP 2144.07).

Referring to claim 1, the combination of Tamatsuka et al, Luter et al, Szekely et al and Lari et al or the combination of Tamatsuka et al, Luter et al, Szekely et al and Morishita et al teach pulling a silicon ingot with a diameter of 8 inches from a 18 inch crucible, a heat shield for reducing defects and vertical magnetic field to eliminate flow instabilities.

Referring to claim 2, the combination of Tamatsuka et al, Luter et al, Szekely et al and Lari et al or the combination of Tamatsuka et al, Luter et al, Szekely et al and Morishita et al teach oxygen concentrations of $0.7x10^{18}$ atoms/cm^3 or more

Referring to claim 3-4, the combination of Tamatsuka et al, Luter et al, Szekely et al and Lari et al or the combination of Tamatsuka et al, Luter et al, Szekely et al and Morishita et al teaches the magnetic filed with an axial upward or downward direction applied selectively at the growing crystal surface vicinity.

3. Claims 1-4 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tamatsuka et al (US 6,139,625) in view of Luter et al (US 6,053,974) along with Szekely et al (US 5,196,085).

The combination of Tamatsuka et al, Luter et al and Szekely et al teach all of the limitations of claim 1, except the traveling magnetic filed being the single type of magnetic field which is applied to the melt. The combination of Tamatsuka et al, Luter et al and Szekely et al teaches providing a traveling magnetic field but is silent to the means of producing the magnetic field.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Tamatsuka et al, Luter et al and Szekely et al by using a magnetic field generator with three coils connected to a 3 phase power supply and a phase angle in an order of 0°-120°-240° because it is conventionally used to produce a traveling magnetic field, note Ou-Yang et al (US 6,636,037), Crowley et al (US 4,808,079), Lari et al (US 4,905,756) and Morishita et al (JP 61-029128).

4. Applicant's arguments with respect to claims 1-4 and 14 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Wilson et al (US 6,284,384) teaches $5x10^{17}$ atoms per cm^3 is equivalent to 10 oxygen atoms per million total atoms in the wafer (col 8, ln 64 to col 9, ln 15).

Nanaka (JP 62-070286) teaches a magnetic field directed downward (Fig 1) and a magnetic field directed upward (Fig 4), note abstract.

Iida et al (US 6,077,343) teaches a Czochralski method employing a heat shield and a magnetic field (col 10, ln 1-67).

Kawanishi et al (US 6,086,671) teaches a magnetic field directed upward a crucible wall (col 3, ln 1-67).

Crowley et al (US 4,808,079) teaches at least two coils which are electrically connected to a three-phase power source is used to produce a traveling magnetic field (col 2, ln 25-35 and col 3, ln 1-20).

Ou-Yang (US 6,636,037) teaches a traveling magnetic field is provided by three coils driven by a phase that is 120° offset from the last phase signal (col 7, ln 1-50).

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703-305-2667. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
PRIMARY EXAMINER